

**UNIVERSITY OF MAINE AT FARMINGTON**

**COLLEGE OF EDUCATION, HEALTH AND REHABILITATION**

**LESSON PLAN FORMAT**

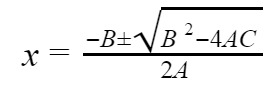
**Teacher’s Name:** Sara Turner **Lesson #:** 2 **Facet:** Self- knowledge  
**Grade Level:**9-11**Numbers of Days:** 4-5  
**Topic:** Solving quadratic equations  
  
**PART I:**  
**Objectives**  
Students will understand that there are multiple was to solve a quadratic equation for an unknown variable.  
Students will know equation, variable, coefficient, constant, distribute, roots, parabola, quadratic, factoring ax^2+bx+c, quadratic formula, order of operations.  
Students will be aware of the multiple ways to solve a quadratic equation.  
**Product:**Prezi  
  
**Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS)**  
**Common Core State Standards**  
**Content Area**: Algebra  
**Grade Level**: High school  
**Domain**: Reasoning with Equations and Inequalities  
**Cluster**: Solve equations and inequalities in one variable  
**Standard** 4: Solve quadratic equations and in one variable.  
**Rationale:** Students will be introduced to the multiple ways to solve a quadratic equation and how to identify which method is best to use in situations.  
  
**Assessments**  
**Formative (Assessment for Learning)**  
**Section I – checking for understanding strategy during instruction**  
After each new method of solving a quadratic equation the teacher will use 4-3-2-1 to assess if the students understand the concept or not. If multiple students are showing a 1 or a 2 this will let the teacher know that they need to spend more time on the concept.  
**Section II – timely feedback for products (self, peer, teacher)**  
The teacher will provide feedback the following class after students present their prezi. The teacher will assess how well the students have grasped the concept and any areas that need to be worked on. Students will then have the chance to individually update their presentations to demonstrate their own abilities to understanding the information.  
**Summative (Assessment of Learning):**  
Students will work with a partner to create a Prezi that showcases each of the ways to solve a quadratic equation. Students must include all ways that the class discusses for solving equations and must demonstrate equations that show which method would be best for solving the equation.  
The teacher will provide feedback the following class after students present their prezi. The teacher will assess how well the students have grasped the concept and any areas that need to be worked on. Students will then have the chance to individually update their presentations to demonstrate their own abilities to understanding the information.  
  
**Integration**  
**Technology (SAMR):**  
The students use of Prezi in this lesson is at the augmentation level because of the effects and presentation of information they are able to do with their presentation. Students will be required to use the many features of Prezi to add to their presentation.

**Content Areas:**  
English- Students will be required to add text to their presentation. They must be sure that they use proper grammar, correct English, and correct spelling on their presentations.  
  
**Groupings**  
**Section I - Graphic Organizer & Cooperative Learning used during instruction**  
Students will use step-by-step organizers to keep track of the different ways to solve quadratic equations. Students will use a pairs discussion to over a set of problems and decide the best method for solving the equations  
**Section II – Groups and Roles for Product**  
Students will work with a partner to create a Prezi to demonstrate the multiple ways to solve a quadratic equation. After presenting their Prezi the students will have a chance to work individually to apply feedback that the teacher provided to rework their Prezi.  
  
**Differentiated Instruction**  
**MI Strategies**  
**Verbal:** Students will take part in pairs discussion to discuss which method they think is best to solve a given quadratic equation.  
**Logic:** Students will need to think and decide which method is best to solve a given quadratic equation.  
**Visual:** While going over the different methods for solving quadratic equations students will have step-by-step organizers to help them keep track of the steps.  
**Musical:** The teacher will play songs related to factoring, completing the square and the quadratic formula and provide the lyrics for students who would like the.  
**Intrapersonal:** After students present their Prezi each student will individually reflect and improve their presentation.  
**Interpersonal:** Students will work with a partner to create a Prezi to demonstrate the different ways to solve a quadratic equation.  
  
**Modifications/Accommodations**  
***From IEP’s ( Individual Education Plan), 504’s, ELLIDEP (English Language Learning Instructional Delivery Education Plan)****I will review student’s IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*  
  
**Plan for accommodating absent students:**  
If a student is absent at any point during this lesson, it is the students responsibility to check the teachers online website for what was discussed in class. If the student is absent on a day when the Prezi presentation is introduced the student must check the teachers online website and speak to the teacher about the presentation as well as check in with their partner. If a student misses a class where a new method of solving is introduced it is the students responsibility to meet with the teacher for help.  
  
**Extensions**  
**Technology (SAMR): Gifted Students:**  
To teach the modification level students will be required to embed a different type of media into their Prezi that enhances their presentation  
**Materials, Resources and Technology**

* Projector
* Graphing calculator
* Textbooks
* Worksheets
* Handout- Prezi instructions
* Handout- Steps for each method of solving quadratic equations
* Different colored markers
* laptops for students
* Graphic organizer
* Hook song lyrics

**Source for Lesson Plan and Research**  
<http://www.eduplace.com/graphicorganizer/-> A great website to find many different graphic organizers.  
<http://cpm.sweetwaterschools.org/files/2013/02/Strategies-A-Z.pdf-> A list of multiple strategies to check for understanding from your students.  
<http://www.ode.state.or.us/opportunities/grants/nclb/title_iii/5cooperative-learning-strategies.pdf-> Different cooperative learning strategies for teachers to use to help students.  
<http://www.math.com/school/glossary/glossindex.html-> Website for mathematical vocabulary  
<http://www.purplemath.com/modules/factquad.htm> Website for help with factoring quadratic equations.  
<http://www.mathportal.org/calculators/quadratic-equation/quadratic-equation-calculator.php> A factoring calculator that will shows steps on how they got their answer.  
<http://www.purplemath.com/modules/sqrquad.htm> Step by step instructions for completing the square.  
<http://www.purplemath.com/modules/quadform.htm> Help with understanding the quadratic formula.  
<https://prezi.com/> The sight where we will be creating our Prezi presentations.  
<http://www.myteacherpages.com/webpages/ALofquist/files/Prezi%20Instructions.pdf> Instructions for creating a Prezi.  
<https://www.youtube.com/watch?v=OFSrINhfNsQ> Hook factoring song  
  
**PART II:**  
**Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)***Take all the components and synthesize into a script of what you are doing as the teacher and what the learners are doing throughout the lesson. Need to use all the WHERETO’s. (1-2 pages)*  
  
In the classroom, desks will be arranged in three rows of two facing the whiteboard. This will allow students to work with a partner easily when needed, and will also make it easy for the teacher to check in individually with students. The teachers desk will be placed at the back of the room to maximize privacy for students needing extra help, while also allowing the teacher to watch over all students.  
  
**Agenda**

**Day One:**  
1) Hook (video) (5 minutes)  
2) Introduction to solving quadratic equations (10 minutes)  
3) Introduce Factoring (45 minutes)  
4) In class practice with groups (15 minutes)  
5) Wrap up/homework (5 minutes)  
Assignment: Factoring worksheet  
  
**Day Two:**  
1) Go over homework (15 minutes)  
2) Review factoring/clarifying questions (15 minutes)  
3) Introduction to completing the square (20 minutes)  
4) In class practice (15 minutes)  
5) Discussion on connection between factoring and completing the square (10 minutes)  
6) Wrap up/homework (5 minutes)  
Assignment: Completing the square and factoring practice  
  
**Day Three:**  
1) Go over homework (15 minutes)  
2) Introduction to the quadratic formula (30 minutes)  
3) In class practice (20 minutes)  
4) Clarifying questions (10 minutes)  
5) Wrap up/homework  
Assignment: Using all three methods to solve quadratic equations  
  
**Day Four:**  
1) Go over homework (10 minutes)  
2) Practice with identifying which method to solve quadratic equations with (20 minutes)  
3) Introduction to Prezi, set up account, discuss project (15 minutes)  
4) Work time with partners (35 minutes)  
Assignment: Finish presentation  
  
**Day Five:**  
1) Meet with partner to discuss presentation (5 minutes)  
2) Presentations (60 minutes)  
3) Final review of material (15 minutes)  
Assignment: Make any revisions you want to based on the teachers feedback  
  
**Teaching and Learning Sequence** (Include all hyperlinks of the above URL's in this section.)  
Students will understand that there are multiple was to solve a quadratic equation for an unknown variable. Quadratic equations can be used to find many things such as the path of a ball that was thrown, or calculating speed.  
*4: Solve quadratic equations and in one variable.*  
The teacher will play the factoring [rap song](https://www.youtube.com/watch?v=OFSrINhfNsQ) to interest students in solving quadratics. Students will be intrigued by the song and will be more interested in learning about factoring equations.  
**Where, Why, What, Hook Tailors:** ***Visual, Musical, Interpersonal, Verbal***  
  
The teacher will start by asking students how they think we would solve a quadratic equation. This will get the students thinking and allow the teacher to see if there are any students that already know anything about solving quadratic equations. The teacher will introduce [vocabulary](http://www.math.com/school/glossary/glossindex.html-%20) words such as factoring, completing the square, quadratic formula, roots, and distribute. The teacher will start with factoring equations and explain how distributing works and how to [factor](http://www.purplemath.com/modules/factquad.htm%20) an equation. Students will use a [step-by-step](http://www.eduplace.com/graphicorganizer/-) organizer to keep track of the steps in each of the different ways to solve quadratic equations. Students will take part in pairs [discussions](http://www.ode.state.or.us/opportunities/grants/nclb/title_iii/5cooperative-learning-strategies.pdf-) to help them decide which method of solving an equation they should use on an equation. The teacher will give great detail on [factoring](http://www.mathportal.org/calculators/quadratic-equation/quadratic-equation-calculator.php), [completing the square](http://www.purplemath.com/modules/sqrquad.htm), and [the quadratic formula](http://www.purplemath.com/modules/quadform.htm)  
**Equip, Explore, Rethink, Tailors:** ***Verbal, Kinesthestic, Visual, Logical, Interpersonal, Intrapersonal***  
  
Students will be able use all three methods of solving a quadratic equation and identify which method is best for an equation. The students will work with a partner to create a [Prezi](https://prezi.com/%20) that showcases the different ways to solve a quadratic equation and how to identify the best method to use. The teacher will have a [tutorial](http://www.myteacherpages.com/webpages/ALofquist/files/Prezi%20Instructions.pdf%20) in class for help with creating their Prezi's. The students will work with a partner to create the presentation and present it to the class. Once the students have presented their Prezi, the teacher will give the students feedback before the end of class on the presentation. The students will then have a chance to reflect on their presentation and individually fix anything that the teacher had noted. This revision will then be submitted to the teacher for additional points. Students have the choice to resubmit the presentation again or not, however all students are required to reflect on the presentation. Part of this reflection will need to include how they worked with their partner and if the work load was equal or not. This will allow the teacher to ensure that both partners contribute to the project.   
**Experience, Revise, Refine, Tailors:** ***Verbal, Logical, Visual, Interpersonal, Intrapersonal***  
  
The teacher will have a rubric for the students presentation. This rubric will be filled out by the teacher while the students are presenting and will give students feedback with the rubric by the end of the class period. The presentation will be graded on the equations students include in their presentation as well as how many of the features of Prezi they utilize. Students will also know they may not receive the same grade as their partner. Students will need to know how to solve these equations for the next lesson of applying them to the real world.   
**Evaluate, Tailors:** ***Verbal, Logial, Visual, Interpersonal, Intrapersonal, Kinesthetic***

**Teacher Content Notes**  
  
**Vocabulary students will know:**   
**Factoring:** (with reference to a number) resolve or be resolvable into factors  
**completing the square:** a technique used to solve quadratic equations, graph quadratic functions, and evaluate integrals. This technique can be used when factoring a quadratic equation does not work or to find irrational and complex roots.  
**Quadratic formula:**   
**Roots:** a number or quantity that when multiplied by itself, typically a specified number of times, gives a specified number or quantity.  
**Distribute:** use (a term) to include every individual of the class to which it refers.  
  
The teacher will start with an equation that can be easily factors such as x^2+4x+4=0 or 2x^2+8x+8=0. They teacher will ask students if they have any idea how we would solve the equation for X. The teacher will acknowledge any suggestions that the students give and write them down to discuss them. The teacher will introduce factoring and explain to students what factoring is. The teacher will talk to the students about distributing and how to break down an equation into to factored terms. The teacher will do many examples on the board and will emphasize to the students that a lot of times they may need to use a "guess and check" method to see if an equation can be factored, and how it should be factored. The teacher will use equations such as7x 2 − 31x − 20. The teacher will give the students a worksheet with equations to be factored, if there are any equations that cannot be factored perfectly the students should say so and leave those blank. The students are able to work with a partner or in a small group for this. The teacher will regroup the class and assign the homework.   
The teacher will go over homework and answer any questions that the students have. The teacher will revisit the questions on the worksheet and homework that were not able to be factored. The teacher will give a completing the square demonstration and explain to students how completing the square works. The teacher will go over multiple examples of equations were completing the square would be useful, such as *x^*2 + 6*x* – 7 = 0 and   
k^2 + 8k + 12 = 0. The teacher will provide a worksheet for students to practice completing the square as well as the equations on the previous handout and homework that they could not solve before. Any equations that the students cannot solve they should mark and leave blank. The teacher will regroup the class and assign homework.   
The teacher will go over homework and discuss any questions there are with the problems. The teacher will introduce the quadratic formula and display multiple ways to remember the formula. The teacher will provide many examples such as 4b^2 + 8b + 7 = 4 and 2x^2 + 3x − 20 = 0. The teacher provide a worksheet with instructions to specifically only use the quadratic formula to solve the equations. The teacher will also have students look back on their previous worksheets and homework and solve any equations they were not previously able to. The teacher will assign homework and have students solve the equations with whichever way they think is the best way for the equation.   
The teacher will go over homework and will discuss with students what they thought was the best way to solve the equations and have them explain and defend their options. The teacher will explain to students that there is no right answer, any of the methods will give them the correct answer. The teacher will have students open their laptops and go to prezi.com if students do not already have an account they should create one. The teacher will have a brief tutorial on how to use Prezi and assign partners for the students. The teacher will discuss the project and go over the rubrics and what is expected of the students. Students will then have the rest of class to work on their projects with their partners while the teacher monitors them. The teacher will regroup the students and let them know they need to finish the presentation for the next class period and be ready to present. The teacher will emphasize that not all students will receive the same grade if the students do not work together on the project.   
The teacher will give the students 5 minutes to meet with their partner and go over their presentation. The teacher will randomly select groups to present their Prezi while the teacher takes notes. The teacher will give students their feedback the same day and allow them to edit their presentations and resubmit them individually for a better grade if they would like. Even if a student does not resubmit their work for a better grade they will need to do a reflect piece to reflect on their presentation as well as how they worked with their partner. After all presentations the teacher will go over any questions students still have and prepare them for the next lesson of applying what we have learned to the real world. 

**Handouts**

* In class practice worksheets for each day
* Homework assignments
* Lyrics to all songs the teacher plays
* Instructions for Prezi
* Rubric for Prezi
* Graphic Organizer

**Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale**  
  
***Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.***  
  
***Learning Styles***  
***Clipboard:*** *The teacher will have a website that has the class calendar on it that gives a brief overview of what was done in class. The any handouts given will be linked to the site as well as all homework assignments listed. Any and all assignment expectations or rubrics will be posted as well.*  
  
***Microscope:****Students will take part in daily in class practice giving them a chance for a deeper understanding of the material. This will also allow students to really have to analyze their own quadratic equations and how to best solve them.*  
  
***Puppy:****The teacher will ensure that students feel comfortable in the classroom. The teacher will encourage students to try to answer questions and will support students giving incorrect answers.*  
  
***Beach Ball:****With some equations there will be more than one way to solve the equation. The teacher will give students personal freedom to choose how they want to solve the equation and allow them to explain their reasoning to the class.*  
  
***Rationale:****This lesson incorporates many different aspects that allow students of different learning styles to best benefit from the lesson. By keeping the lesson diverse the teacher is able to help the most amount of students succeed.*

***Standard 6 -* *Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.***  
  
***Formative:***  
**Section I – checking for understanding strategy during instruction**  
After each new method of solving a quadratic equation the teacher will use 4-3-2-1 to assess if the students understand the concept or not. If multiple students are showing a 1 or a 2 this will let the teacher know that they need to spend more time on the concept.  
**Section II – timely feedback for products (self, peer, teacher)**  
The teacher will provide feedback the following class after students present their prezi. The teacher will assess how well the students have grasped the concept and any areas that need to be worked on. Students will then have the chance to individually update their presentations to demonstrate their own abilities to understanding the information.  
  
***Summative:***  
Students will work with a partner to create a Prezi that showcases each of the ways to solve a quadratic equation. Students must include all ways that the class discusses for solving equations and must demonstrate equations that show which method would be best for solving the equation.  
The teacher will provide feedback the following class after students present their prezi. The teacher will assess how well the students have grasped the concept and any areas that need to be worked on. Students will then have the chance to individually update their presentations to demonstrate their own abilities to understanding the information.  
  
***Rationale:***  
*These assessments allow the teacher to be sure that students are truly understanding the material. The assessments still take into account all different types of learning styles and allows all students to showcase their knowledge.*  
  
***Standard 7* - *Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.***  
  
***Content Knowledge:***  
Students will know equation, variable, coefficient, constant, distribute, roots, parabola, quadratic, factoring ax^2+bx+c, quadratic formula, order of operations. (See content notes)  
  
***MLR or CCSS or NGSS***  
**Common Core State Standards**  
**Content Area**: Algebra  
**Grade Level**: High school  
**Domain**: Reasoning with Equations and Inequalities  
**Cluster**: Solve equations and inequalities in one variable  
**Standard** 4: Solve quadratic equations and in one variable.  
b: Solve quadratic equations by inspection (e.g., for x^2=49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a+-bi for real numbers a and b.  
  
***Facet:****Self-knowledge*  
  
***Rationale:****Students will learn three different ways to solve quadratic equations. They will understand the difference between them and how to identify which method of solving by looking at an equation.*  
  
  
***Standard 8 -* *Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.***  
  
***MI Strategies:***  
**Verbal:** Students will take part in pairs discussion to discuss which method they think is best to solve a given quadratic equation.  
**Logic:** Students will need to think and decide which method is best to solve a given quadratic equation.  
**Visual:** While going over the different methods for solving quadratic equations students will have step-by-step organizers to help them keep track of the steps.  
**Musical:** The teacher will play songs related to factoring, completing the square and the quadratic formula and provide the lyrics for students who would like the.  
**Intrapersonal:** After students present their Prezi each student will individually reflect and improve their presentation.  
**Interpersonal:** Students will work with a partner to create a Prezi to demonstrate the different ways to solve a quadratic equation.  
  
***SAMR:***  
The students use of Prezi in this lesson is at the augmentation level because of the effects and presentation of information they are able to do with their presentation. Students will be required to use the many features of Prezi to add to their presentation.  
  
***Rationale:***  
Students will be able to showcase the different ways to solve an equation in a way that encourages creativity. Students should take advantage of the many effects and tools that Prezi has to offer to make their presentations come alive.  
  
***NETS STANDARDS FOR TEACHERS***  
**1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.**  
a. Promote, support, and model creative and innovative thinking and inventiveness  
  
b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources  
  
c. Promote student reflection using collaborative tools to reveal and clarify students’ conceptual understanding and thinking, planning, and creative processes  
  
d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments  
  
***Rationale:****a, b, c, d. Students will be solving equations on their own as well with other students. Students will need to demonstrate their knowledge with the use of technology. Students will also have the chance to reflect on their work and make adjustments as they wish.*  
  
**2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.**  
a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity  
  
b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress  
  
c. Customize and personalize learning activities to address students’ diverse learning styles, working strategies, and abilities using digital tools and resources  
  
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching  
  
***Rationale:*** *a,b,c,d. Students will have the opportunity to research their own quadratic song if they choose. Students will also be able to create their own presentation and make it as creative as they wish. The teacher will encourage students to take their own approach to their presentation to accommodate* *all learning styles.*